MAIN CURRENTS

IN MODERN THOUGHT

The Dark Nebula in Orion

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MAIN CURRENTS IN MODERN THOUGHT

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The photograph on the cover shows the Horsehead Nebula in Orion, photographed in red light by the 200" telescope at the Mt. Wilson Palomar Observatory. At left is a photograph of a larger part of this dark mass south of Zeta Orionis, to show the placement of the prominence. Both of these photographs have been given a quarter turn to the left from the position in which they are usually observed, in order to show the configuration more clearly. Opinion among astronomers has been generally in agreement that the dust-particle mass of the nebula emits no light of its own. The nebula is at a distance of about 325 light years from our sun, and covers 5 minutes of arc in the sky, which can be calculated to indicate that it is approximately ½ a light year across. That is to say it stretches a distance covered by light travelling for ½ a year at the rate of 186,000 feet a second, "darkness covering the face of the deep."

MAIN CURRENTS IN MODERN THOUGHT is published 5 times a year in Sept., Nov., Jan., March, and May, to call attention to significant contributions to learning currently being made by workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can and should be made the central core of curricular study in the educative process at all levels of development. In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Foreign $3.50. Contributors to MAIN CURRENTS enjoy full liberty of opinion and expression in these pages. *Copyright 1954, by F. L. Kunz, Port Chester, New York,* *to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. Entered as second class matter April 13th, 1946, at the post office at Port Chester, New York, under the Act of March 3rd, 1879. (Re-entered as second class matter November 17th, 1953, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.)*

ON THE FUNCTIONAL ORGANIZATION OF THE HUMAN BRAIN*

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Observations on Neurone Mechanisms Involved in Consciousness and Memory

In Proverbs it is written: "For as he thinketh in his heart so is he," and again a thousand years later at the time of the birth of Christ, "Mary kept all these things and pondered them in her heart." It was only yesterday that Vannevar Bush slipped back into the same manner of speaking: "The seat of ethics," he said, "is in our hearts, not in our minds." (I'm sure he must be flattered by the succession in which he thus appears!)

But in the Elizabethan era even Shakespeare spoke otherwise, referring to the "brain which some suppose soul's frail dwelling house." Medical men had by that time come to consider the brain to be the organ of the mind, believing that it functioned in some mysterious manner as a whole without localization and specialization of functions. Even today, although we are awed and even frightened by the intellectual achievement of man's mind, the mechanisms that made it possible are still unknown.

In his brilliant address, Mr. Justice Frankfurter suggested that it is our privilege here to discuss those things of which we are least ignorant. I would follow his example, for the man who understands his own problem should be able to speak of it simply. Such simplification constitutes the charm of the meetings of this Society.

Knowledge of the outward form of the brain is well advanced. The pathways of sensation and of movement within the brain have been, and are being, charted. But what of the neurone mechanisms involved in consciousness, perception, memory? Far off, it seems to me, we hear the humming of the machinery of the mind and, from time to time, we gain fleeting glimpses of its action. But still we stand in awe upon the threshold of understanding. I shall describe certain glimpses that have come to me by patience and by good luck.

But first I must make reference to what is common knowledge of the human brain (Fig. 1). The mechanisms of reflex movement are well worked out. Voluntary action is produced by nerve impulses that originate within the brain and pass out along a succession of nerve-cell nerve-fibre connections into the peripheral nerves and so to the muscles which make movement by their contraction.

We know something about how the sense organs in the eye, the ear, the nose and the skin transmute the stimuli of light, sound, floating particles and touch into afferent streams of nerve impulses. These streams follow separate pathways into the brain to make possible the functions of vision, hearing, balance, smell, and touch. These streams of sensory impulses, which are like electrical currents, differ from each other in that they have separate goals in the central nervous system. The nerve cells in each goal, when activated, send on impulses into the neurone circuits which make possible conscious perception of things seen or heard or felt. For example (Fig. 2) the visual pathway leads from eye along optic tract (Opt. T. Fig. 2) to vis-

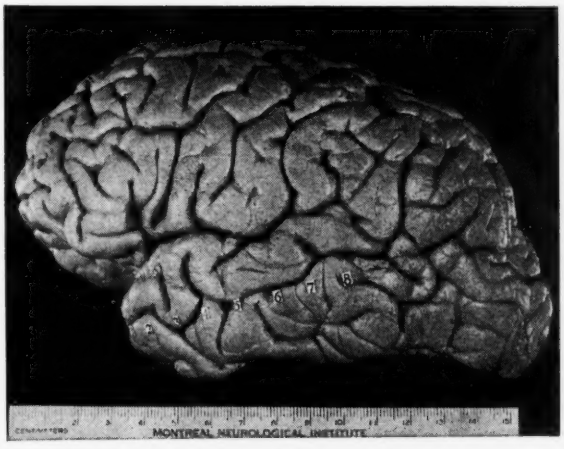

Fig. 1. The left hemisphere of the human brain covered by cerebral cortex or gray matter. Only about 35 per cent of the cortex is on the external surface of the convolutions. The rest is buried in the walls of the fissures.

* An address before the American Philosophical Society, Philadelphia, April 23, 1954. Published in the *Proceedings of the American Philosophical Society*, Vol. 98, No. 5.

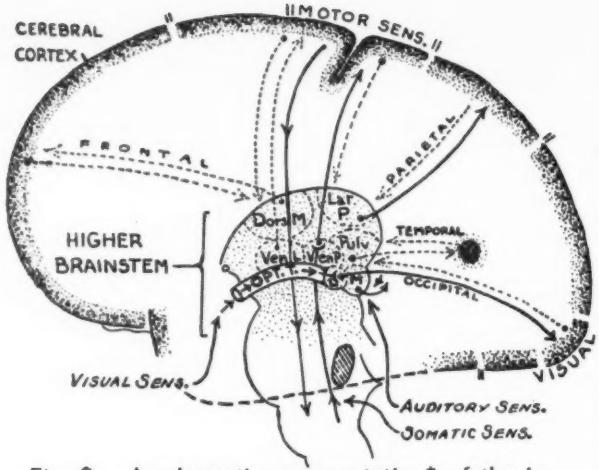

Fig. 2. A schematic representation* of the interconnection of neurone circuits between the higher brain stem and the various functional areas of the cortex of both hemispheres. These converging connections and the integrating mechanisms within the brain stem make up the centrencephalic system.

ual center in the occipital lobe of the cerebral cortex, but from there impulses pass onward to play a role in the more complicated mechanisms of integration.

But what of the neurone mechanisms of consciousness? What of thought, memory, behavior, and speaking? Here the experimental physiologist stops. He can help us little. Here we must consider the brain and the mind of man himself. It is true that Pavlov and others have thrown some light upon the parts of the brain used in animal behavior and in learning, by study of the conditioned reflexes. But this takes us such a short way toward the basic understanding that we seek.

Certain general principles of organization emerge. The area of final coordination and integration of neurone activity in the central nervous system is evidently situated in the higher brain stem. These coordinating circuits are essential to the very existence of consciousness. Almost any interference with this portion of the nervous system either by compression or disease produces unconsciousness. This is the portion which has symmetrical connections with the gray cortex of both hemispheres. It contains a converging and diverging system of nerve fibre connections which we may call the centrencephalic system to indicate that it constitutes the functional center of the brain or encephalon.

The centrencephalic system occupies what may be called the old brain, corresponding with the rudimentary head of the central nervous system of lower forms of life.

Higher mammals and especially man are provided with superimposed hemispheres covered by an ever more extensive mantle of gray matter, the cerebral cortex. This gray cortex is composed of millions of nerve cells, or ganglion cells and, in the case of man, the cortex has so increased in extent that it is formed into deep folds or fissures that convert its surface into convolutions.

Each of the functional areas of this cortex is in a sense a separate projection from the brain stem so that each portion makes possible new and more complicated functions (Fig. 2). But no area of cortex is independent and none is capable of effective function without its corresponding portion of the old brain. Indeed it seems to be through the brain stem that the new capacities of each area of the cortex are utilized.

Thus it is that the sensory areas of the cerebral hemispheres are no more than way-stations in the several currents that carry different forms of sensation into the centrencephalic integrating system, and the cortical motor areas are way-stations in the stream of out-flowing impulses that produce motor activity. Large areas of cortex may be destroyed or removed without producing unconsciousness although this does interfere with the function to which the injured areas were devoted.

In order to treat certain conditions, such as focal epilepsy, it is sometimes necessary to operate under local anaesthesia and to stimulate the brain of conscious men and women with gentle electrical currents. When applied to the motor area of the cortex such stimulation produces crude movement because the current is conducted outward through the spinal cord and nerves to the muscles. This current does not enter the integrating area and the patient is surprised to discover that his hand, for example, has been caused to move.

If the surgeon's electrode is applied to one of the sensory areas (somato-sensory, hearing, vision in Fig. 3) the impulses do pass into the centrencephalic system and the patient reports that he feels or hears or sees something, the nature of the sensation depending on the area selected. But the sensation that he experiences does not resemble things he sees or feels or hears in everyday life. Instead it is a crude sensation, such as simple lights and colors or a tingling of the fingers or a ringing sound.

But the sensory and motor elaborations of function are not the only uses of the cerebral cortex. There are large areas that are devoted to what may be called psychical function, particularly in the anterior frontal lobes and the temporal lobes. The most remarkable change in brain form, passing up the scale from dog through monkey to man, is the comparative enlargement of frontal and temporal lobes, and there can be little doubt that this is associated with man's supremacy in the intellectual sphere.

During the past twenty years it has been my good fortune to discover from time to time that similar stimulation of the temporal lobe cortex occasionally produced a psychical response, something of a different order from the motor or sensory effects previously described.

The patient might exclaim in sudden surprise that he heard music, or that he heard a well known person

* From Penfield and Jasper, *Epilepsy and the Functional Anatomy of the Human Brain*. Little, Brown and Co., 1954.

speaking, or that he saw something he had seen before, or that he was himself taking part in a former experience in which he was himself an actor.

At such times the patient continued to be aware of the fact that he lay upon the operating room table, and yet the recollection continued, in spite of himself, as long as the electrode was kept in place, to vanish instantly when the electrode was withdrawn. Brief examples may be given.

A young woman heard music when a certain point in the superior surface of the temporal cortex was stimulated. She said she heard an orchestra playing a song. The same song was forced into her consciousness over and over again by restimulation at the same spot. It progressed from verse to chorus at what must have been the tempo of the orchestra when she had heard it playing thus. She was quite sure each time that someone had turned on a gramophone in the operating room.

A South African who was being operated upon cried out in great surprise that he heard his cousins talking, and he explained that he seemed to be there laughing with them although he knew he was really in the operating room in Montreal.

There were many other examples of hearing music but always the patient heard a singing voice, or a piano, or an organ, or an orchestra, and sometimes he seemed to be present in the room or in church where he had heard it. What he heard and experienced was a single occasion recalled to him with a vividness that was much greater than anything he could summon voluntarily by effort of his will.

If the individual were asked later to recall the song, he might be able to sing it, but he might not be able to recall the circumstances of any one previous hearing. His later memory of the song was a generalization. On the other hand the electrode had reproduced for him one single previous experience when he had heard the music and it awakened in him the emotion which that particular situation had originally roused in him.

In summary it may be said that the electrode, applied to temporal cortex, recalls specific occasions or events so that the individual is made aware of everything to which he was paying attention during a specific interval of time. Such responses have followed stimulation only in cases in which the cortex had been the site of previous habitual epileptic discharges. Although the content of the recollection thus evoked often bears no relationship to the physical content of the seizure, it is possible that the cortex has been rendered more readily stimulable by the epileptic state.

These results were obtained in the temporal cortex only, (Fig. 3, memory patterns) an area of the brain to which no certain function has been previously ascribed. I must conclude that there are in this area permanent records of these experiences preserved somehow in the form of ganglionic patterns that can be re-activated by the electrical impulses delivered to the cortex by the operator's electrode.

It may be assumed then that in this area of cortex each successive conscious experience is laid down in a relatively permanent pattern of nerve cell connections that records all those things of which a man is conscious at any given time. It is as though the cortex contained a continuous strip of cinematographic film, a strip that includes the waking record from childhood onward.

One must assume that the right and the left temporal lobes give similar service in this regard and that the memory record is duplicated on the two sides, since removal of a large part of one lobe does not usually interfere with a man's capacity to recollect or to recognize the things seen before.

Presumably these patterns are no more than pathways of permanent facilitation through pre-existing connections of many branching nerve cells. When the electrode is applied, the current seems to follow again this pathway, slowly, steadily, while all other neighboring pathways are somehow closed by the influence of some all-or-nothing principle.

There is other evidence that such detailed patterns of previous experience are preserved within the brain. Take an example from what must be your own experience, as it has been mine. Let us assume that you have not seen a friend for many years. Once you knew him well, but now, after 10 or 20 years, you cannot picture him and certainly you could not paint his picture.

But suppose you come upon him unexpectedly. As he turns and looks at you and smiles there is a sense of familiarity. Suddenly you recognize your former friend. But even as you focus your attention upon him you realize he is altered in little ways. There is a difference between this moving, talking, laughing individual and the record of him that is preserved in great detail in your own brain, the record you could not have conjured up a moment before.

Now you see new lines in his face, an altered stoop to the shoulder, a strange slowness of movement. The

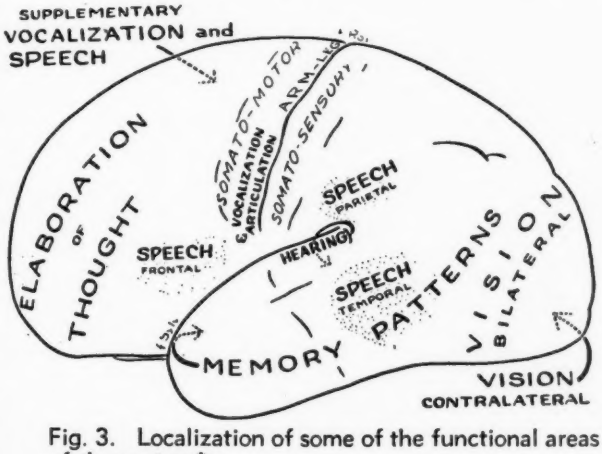

Fig. 3. Localization of some of the functional areas of the cortex.*

* From Penfield, W. "Observations on Cerebral Localization of Function." IV Congrès Neurologique International, Paris, 1949. Vol. III, *Comptes Rendus,* Paris, 1949.

voice is the same, perhaps, and the eye seems to twinkle with the same old understanding. You probably clap him on the back and tell him (for his own good) that he has "not changed a bit." But even as you shake his hand you feel another alteration, for you perceive that the joints have thickened.

You feel the necessity of calling him by name. That requires a separate physiological act, for the mechanism of speech and the whole process of summoning words that are appropriate to the content of new thought bear only a distant relationship to those aspects of memory included in our present discussion.

It is obvious that you have preserved the records of the way your friend walked and talked and smiled during a long succession of interviews. When you met him again you reopened the old "file," rediscovering and reviving its contents. These are not portraits of still life, they are strips of action, each one as long as the periods of time during which you focused your attention upon him.

This must be the same sort of strip that the neurosurgeon stumbled upon when he placed his exploring electrode at random upon the patient's hypersensitive cortex. A gentle electrical current, of 60 impulses per second for example, applied at a point on the temporal cortex activated one strip of experience and only one at a time. Thus, past experience was brought into the present, and the patient was aware of a doubling of his consciousness. An experience on a South African farm and present experience in a Montreal operating theatre were presented to consciousness simultaneously. The man himself pointed out his awareness of the incongruity of the situation in his initial exclamation. He made his own decision as to which was the true present, and which must be the counterfeit. Patients often say, "This is not a memory; it is more vivid than that." The mechanism which the electrode has brought to light might well be considered an essential element in the very basis of consciousness by use of the following hypothesis:

The pattern of each successive experience is somehow projected from the centrencephalic system outward to the temporal cortex on the two sides (including hippocampal regions perhaps) in a continuous flow of patterned impulses, a flow that is interrupted only by deep sleep or by coma. It would seem that the projection could only come from this central integrating area, since it is there and only there that all sensory and psychical elaborative circuits converge. Each experience is made up of those elements of sensation of which a man is, for the moment, aware, together with his interpretation of each experience and the attendant emotion.

It must be that this outflow of nerve impulses creates a ganglionic pattern in the temporal cortex although perhaps not wholly there. Furthermore, it may be that a reprojection of impulses back from the temporal cortex to the centrencephalic system occurs invariably like a reflection in a mirror, a reflection of which the individual takes cognizance. That may seem an extraordinary hypothesis and yet, if stimulation with a simple electrical current can recreate a total experience, the reflection mechanism exists. The neurone record is there and the records of previous similar experiences are there also, so that judgments of familiarity or strangeness and other elaborative processes may be made. I suggest that reflection or reverberation back into the centrencephalic or integrative circuits must occur normally.

I would surmise then that the neurone processes involved in the original creation of the record of present experience are those involved in the act of attention, and that the instantaneous reprojection or reflection of the record back again together with some sort of reflection of previous similar experience constitutes an essential neurone mechanism in consciousness.

It is obvious that nerve impulse is somehow converted into thought and that thought can be converted into nerve impulse. And yet all this throws no light upon the nature of that strange conversion.

Before certain problems the scientist will always stand in awe. Perhaps he may be forced to make another approach — to, what was called in old times, "the heart." However far our successors in these studies may go, it is my belief that the machine will never fully explain the man, nor mechanisms the nature of the spirit.

Between the extremes of vitalism and scientific naturalism lie theories that are most valuable to the present-day biologist. Joseph Needham quotes from *Microcosmos* by Hermann Lotze: "The true source of the life of science is to be found, not indeed in admitting now a fragment of one view and now a fragment of the other, but in showing how absolutely universal is the extent, and how completely subordinate the significance, of the mission which mechanism has to fulfill in the structuring of the world." Needham proposes that "Neo-mechanism would therefore seem to be the theory of biology best adapted for the future, for it only advocates mechanism as methodologically essential, and does not claim to give a truer account of the world than the organicism of the philosopher or the other interpretations, perhaps impossible to formulate, of the religious man and the poet or the artist."—*The Sceptical Biologist,* Joseph Needham, W. W. Norton, 1930, p. 28.

CHAOS OR CONFIGURATION*

H. S. Burr

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Experiments With Directive Forces Controlling Organization of Living Things

What is this Nature we see around us? Is it confusion and chaos, with nothing in it that can be predicted; or does Nature exhibit regularities, configurations which can be described with considerable confidence and which bear relations to other components that can be predicted? This is an age-old problem. Solutions have been sought by many different students. In all probability, the majority of these has been convinced that Nature does exhibit laws, and that the apparent chaos is due to our ignorance. However, there has always been a minority who, looking at fractions of the whole picture, has seen only the unpredictable, and has insisted, therefore, that what seems to be law and order is merely the regularities imposed on chaos by the mind of man. The vanity concealed in this last point of view should be fairly obvious. Even though one has great respect for the powers of the human mind, to assert that it invented gravitation, for example, implies powers that transcend understanding. And yet the cosmos presents a perennial problem which recurrently needs solution, even though it be admitted that no current answer is ever final.

Unfortunately, the rapid advance of knowledge of the sub-microscopic in the universe has led many to find in the chaos of charges and/or regularities evidence that exact descriptions cannot be provided, but that only the laws of probability can be trusted. Such thinking is rather superficial, because it can be argued that the apparent chaos of the sub-microscopic is not real, but due to our ignorance or to the failure of our method of analysis. Finally, many men point to the great lack of uniformities in human behavior as further evidence supporting confusion in the Universe.

From another vantage point, however, one can get a very different picture. Most of us can look out on the world and see regularities which we can describe with considerable certainty, and which from day to day retain their described characteristics. This is the kind of thing which makes up the basis of physics and chemistry. We not only recognize the entities, but we codify the rules of the game in which they play a part. If one were to tot up the items on the chaos side of the ledger, and those on the law and order page, the balance would be overwhelmingly on the side of law and order.

But, of course, the conflict does not stop there. Many believe that man is in the universe but not of it. While he is made up of chemical substances which behave in a fairly regular fashion, nevertheless he has some attributes which seem to transcend what we know of physics and chemistry. For many, then, there is a curious dichotomy; a physical world, exemplified by law and order, and a spiritual world also exhibiting law and order but of a different kind. Such thinking assumes that man is a special creation, something over and above the material universe.

This is the basic conflict of science and religion. It is curious that in recent years more and more of our best minds are trying to erase this dichotomy. Unfortunately, there have been few, if any, significant attempts to build an adequate foundation of knowledge and understanding which would wipe out the differences and leave them resting solidly on a clear understanding of the whole universe, including man. Can this be done?

It is not likely that any of us will arrive at a completely adequate solution, but after all, it is the struggle involved in the search for answers that makes life so much fun. The search for truth is an uphill climb with many obstacles. It is reasonably clear, however, that in many spheres of activity we can discern an upward progress.

During the last century science has grown by leaps and bounds, and in many instances this has resulted in a kind of deification of science. Mostly these opinions have arisen in the lay mind, for any practicing scientist knows well that Benjamin Franklin was correct when he said that *quantity* of knowledge is a very small fraction of the *quantity* of ignorance. Science is not perfect, yet it has accomplished miracles, and it is not surprising that many have thought that the application of the same methodology to the problems of living beings in general, and to human beings

* Condensed from an address given by Dr. Burr, who is E. K. Hunt Professor of Anatomy, and Head of the Section of Neuro-Anatomy at the Yale University School of Medicine, to the Colloquium on the Nature of Man. For further discussion of this Colloquium, see News and Notes.

and their relationships in particular, would yield similar startling results. This may be so, and therefore it may be worthwhile to examine the method of science. Very simply stated, the practice is this:

The first step is to collect and meditate upon as much of the describable data as can be readily culled from the records of the past. Out of the contemplation of this material there comes to the imaginative mind of the scientist a new synthesis of the entities. Unfortunately, this intuitive leap of the mind cannot be ordered. No one can define the necessary conditions. Everyone who is contributing to our understanding of the physical world, to our awareness of its beauty, of its law and order, proceeds in the same way; all exhibit this capacity to see unexpected relationships in the world around us. This is not something mysterious. We all have hunches about things. The next step in the procedure consists of trying to find out if our guess is true. Fortunately, the method by which the hypothesis is tested is subject to regulation; in short, to the rules of logic.

Given the assumption, the logical consequences must be subjected to rigorous tests in experience. No matter how simple the assumption may be, there usually are a great number of logical consequences; more than can be conveniently subjected to the validating procedure. Usually there are innumerable variables surrounding the test procedure, and the scientist works very hard to set up conditions which maintain most of the variables constant. Usually the procedure involves some predictions. These "epistemic correlations," or "correspondences," if found under the conditions of the study, strengthen the validity of the assumption, and indicate that the guess is correct. Unfortunately, of course, it cannot be said that the assumption is absolutely true, for there may be some other assumption, the logical consequences of which exhibit the same correlations. However, it does give us courage to continue in the hope that further study will either strengthen the assumption or lead to a new assumption with greater validity.

This process has been used by mankind from the beginning in every sphere of activity. The scientist, perhaps, has one condition which must be met which is not so clearly discernable in the arts and humanities. In science, controlled experimental conditions must be arbitrarily created in order that the predictions may rest upon a solid foundation. There are certain other conditions that must be met. The complex system being studied, ideally, should not be disturbed by the experimental study. In addition, the magnitudes of the changes under the experimental conditions must be determined with all the accuracy possible. Measurement then becomes a necessary tool. The results should not be matters of opinion but a quantity that can be stated in figures.

This brief and probably over-simplified statement of the methods by which man discovers truth must not be taken as final but simply as an attempt to prepare a possible foundation on which to rest a somewhat different approach to the questions raised by the nature of the universe in which we live.

So, let us pursue an adventure in the methods of science. For this adventure, we must have a point of departure: The premise that the universe is a place of law and order; that it exhibits configurations, a pattern of organization, a design. With this must go the adjuvant premise that the necessary relatednesses are the products of laws operating as forces of great magnitude and precision, not only on the stars in their courses, on the properties of hydrogen and oxygen, but also on all describable elements of the living system.

If the above be accepted, let us apply the method of science to the problem posed by the pattern of organization of living things. This, of course, is the key problem of biology as well as of cosmology. To choose the living organism as a subject of study may seem foolhardy, for it is widely known that even the simplest living thing is complex beyond our understanding. On the other hand, if clues to the origin of design in the living system can be found, the consequences have almost unlimited possibilities.

The first step is to examine the available data regarding living organisms. To generations of students in biology, it has been obvious that every living thing, from amoeba to man, is an extraordinarily complex configuration of a relatively small number of chemical elements. These elements are, in all probability, in a constant flux — combining, breaking apart and recombining in a continuing and unending process. And yet, even in the face of constant chemical activity, the unity of the organism is maintained and a describable configuration continued. But there is something more than the integrity of the organism. As we study its development it becomes abundantly clear that, starting from one or two cells, growth and differentiation proceed toward a definite goal — the configuration of the adult. This adult structure cannot be the consequence of chance; it is the result of an ordered process resulting from the impact of forces of extraordinary precision. The growth of the embryo to maturity has direction.

This is not the only place where direction can be observed in living things. One needs to examine only briefly the data collected by students of evolution to see that the operation of unknown forces has led to the appearance of more and more complex living beings, the result of which has been the appearance of uniquely different individuals. It is hard to tell two fish or two frogs apart, but no one has any difficulty in distinguishing two human beings, even twins. So natural history suggests that living things exhibit configurations which are the result of forces operating with direction both in evolution and in growth and development. This should make it clear that some of the clues leading to a possible solution of our problem may be found in a search for these directing forces.

There is another thread which must be woven into the pattern of the proposed hypothesis. This thread

begins in Galvani's acute observation of the twitching frogs' legs drying outside his window. That led to the postulation of animal electricity. A great boost was given to studies of this sort as a result of the development, by Einthoven, of the string galvanometer. During the last sixty years, the electro-cardiogram has become an important element in the diagnosis of disorders of the heart. Following that came the discovery of the changing electrical output from the brain. Development of the modern vacuum tube has greatly accelerated the development of the instruments necessary for such studies, but gives little or no clue to the nature of the steady state potential from which these variations spring, first given serious consideration by Lund.

We have, then, two lines of evidence gleaned from the natural history of living organisms. The first is that directed configuration is characteristic of the evolution of the living organism, in general, and of its development, in particular. The second line indicates that electrical phenomena in living things are highly important and useful phenomena. It is, of course, well known in physics that there are not many forces operating with direction. Gravitation is one, and the electrical nature of the universe, as exemplified in field forces, is another.

May it not be possible, then, to add these two different kinds of phenomena together? Living organisms exhibit directed forces. Field forces have this directive property. Therefore, it may not be too far amiss to assume that the measurable electrical properties of a living system are, in some sense, descriptive of the presence in every living organism of a describable electrodynamic field. If this field could be charted with sufficient precision, we might have a picture of the directive forces which control the organization of every living thing.

The next step in our adventure lies in working out the logical consequences of the above assumption. Four questions must be put to Nature:

1. Are there relatively steady state standing potentials in every form of life?
2. Do these reproducible potentials exhibit any configurations?
3. Can these configured potentials be in any sense of the word measurable attributes of an electodynamic field?
4. Is such a field a consequence of the living process or is it, as the basic assumption would require, a primary attribute of protoplasm, capable of organizing its structures and activities?

This is not the time nor the place to review in detail the results of some twenty years of experimentation arising out of the hypothesis. The original statement by Burr and Northrop led to a very exciting adventure in the laboratory with results which turned out to be reproducible and, in most instances, predictable. Every living organism measured exhibited voltage differences. These were not chaotically arranged, but exhibited a pattern or configuration related in an apparently significant way to the structure of the living organism. That these pattern potential differences were aspects of a field was clearly evidenced by the fact that the differences could be detected well outside the surface of the living organism in aquatic animals.

The answers to the first three questions were not too difficult. However, the answer to the fourth question is fraught with almost insurmountable obstacles. Ideally, if the primitive assumption is true, it should be possible to modify the course of development by placing the living embryo in an external field of sufficient magnitude to disturb the embryo and its field. To create a steady state field of sufficient magnitude to overcome the living field would require an enormous expenditure of energy at very great cost. It is necessary, therefore, to attempt a solution by a rather roundabout route.

Many years ago, Lund and his associates made it clear that one could change the direction of growth of primitive organisms by subjecting them to a variety of electrical environments. These findings have been confirmed by Marsh and Anderson, to name only two of many investigators. It is hard to imagine such consequences arising from anything but the impact of external electrical forces on the internal electrical forces of the organism. Somewhat more obvious is the fact that one needs not be in contact with the heart, or brain, or nerve to record changing electrical outputs. Such determinations simply could not be made were it not for the propagation of the rapid changes through the medium of an inherent field. Moreover, the application of electric shock to both heart and brain results in changes in biological activity. The evidence seems to point to the fact that the predicted consequences of the original assumption have been demonstrated; that in some sense, at least, changing the electrical environment of a living system alters certain aspects of its fundamental activity.

There is, finally, one more aspect to this study of configuration. More than twenty years ago, F. S. C. Northrop published a valuable and exciting exposition of the relationship between field forces and the patterns of organization in the physical universe.* He presented a great mass of evidence to support the conclusion that the universe could be characterized by an electrical field which gave unity to the whole and which imposed position and direction of movement on all the entities which could be described. If the universe displays the properties of a field, and the living organism also exhibits the same phenomena, then, so far as our present knowledge goes, the two fields must inevitably interact.

This makes it necessary to pose a fifth question to Nature: Can the effect of any cosmic forces on the living organisms be measured? In some ways this seems a foolish question because all living things are

* "Experimental Findings Concerning the Electrodynamic Theory of Life and an Analysis of Their Physical Meaning," *Growth*, V. 1, no. 2, April 1947, p. 78-88.

dependent on light, on gravitation and, quite probably, on many other factors of cosmic origin as yet unknown to us. But since we are dealing with a problem in electricity our theory predicts that the electrical forces of the universe should have impact upon the electrical characteristics of the organism. Ideally, one should have a very complete, continuous, electrical record of the moment-to-moment changes in electrical output of a living system. With animals this is well nigh impossible, but plants are living systems, and they have the enormous advantage of being stationary.

A tree was selected for this experiment. Two electrodes were let into the cambium, just beneath the bark, about four feet apart, with the lower electrode some two feet from the ground. With these two electrodes connected to a continuously recording galvanometer, we now have more than ten years of practically continuous measurements. These records will require years of careful statistical analysis. However, there are three aspects of these records which seem to be provocative.

First, the record of each succeeding year tends to repeat the same pattern: a high in the early winter, a low in the early summer. In between there seem to be cyclic repetitions which correlate not at all with temperature, humidity, or barometer. Instead, the nearest cosmic phenomena is the lunar cycle. Moreover, the winter high and the summer low differ not too widely from the apogee and perigee of the moon. Lest someone suspect that this is a re-affirmation of the folkways' determination of the time to plant potatoes, let it be said that if such correlations with the lunar cycle exist, they do not mean that the moon is doing things to living organisms; rather, that possibly the same forces which act upon the moon act on living organisms also. This, of course, in not entirely unknown in biological history, for the spawning of the Palolo worm is known to occur at certain phases of the moon.

Finally, this study was initiated, by accident, at the time of a sun spot low. These sun spots are believed to grow and wane in nine to eleven year cycles. During roughly the first half of the study, the number of relative sun spots increased, and there was a steady rise in the potential differences in the tree. Since then, as the relative sun spot numbers have decreased, so also have the electrical differences decreased. It can be argued, of course, that one tree is an exceedingly small sample of living organisms. This is admitted, and the evidence so far collected cannot be called definite, but simply suggestive.

The implication would seem to be that the forces determining the configuration of the universe also set the pattern of the living system. What does it mean?

While it is admitted that the evidence reviewed here is not by itself very impressive, yet the literature contains a great deal of data which indirectly fits into this picture. There may be other hypotheses the same evidence would validate. Nevertheless, there is enough material to provide a reasonable foundation for the faith that it is a valid hypothesis and that the clues derived suggest some worthwhile implications. It seems obvious that with the configuration of living things brought into line with the configuration of the universe, we must accept a universal pattern of organization. Moreover, since the changes in the patterns of both the universe and of living things have had direction, it is practically impossible to escape the conclusion that the universe and all it contains is the result of design. We cannot think of a single item in our physical environment that has not been designed by someone to fulfill a specific purpose. How, then, can we escape the conclusion that the universe is the outcome of directed purpose and the product of a Designer?

Finally, if the argument presented here is sound, living organisms as a part and parcel of the universe must be integral and unique elements in that design, contributing their functions to the final goal.

This is not the time or place to explore the last consequence further, but at least it leaves us something to ponder and to investigate. It is true that the various laws of conservation of mass and energy known in the physical world are equally applicable in the living world, so that nothing is ever lost. The Greeks had a name for it, this *Cosmos,* one minute corner of which we occupy. It is not confusion or chaos; not just exemplification of the laws of probability alone, but a place of law and order which the mind of man can comprehend. It is in every sense of the word a universe.

"The universe is represented in every one of its particles. Everything is made of one hidden stuff . . . The world globes itself in a drop of dew. We put our life into every act. The true doctrine of omnipresense is that God reappears with all his parts in every moss and cobweb. Thus is the universe alive. All things are moral. That soul which within us is a sentiment, outside of us is a law. We feel its inspiration; but there in history we can see its fatal strength. The world looks like a mathematical equation, which, turn it how you will, balances itself. Every secret is told, every crime is punished, every virtue rewarded, every wrong redressed, in silence and certainty.—Taken from Ralph Waldo Emerson's *Compensation, Essays,* 1st Series, Lon. Macmillan, 1924, pp. 81-82.

THEORETICAL CREATIVITY IN PSYCHOLOGY*

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The Various Points of View Influencing The Science of Human Behavior

I take it that the "creativity" mentioned in the program of this Workshop refers to the achievement of significant ideas, insights, or hypotheses which may facilitate the advancement of scientific research and the application of its outcomes. A scientist's work is not creative except in this sense. His job is discovery, and his creativity is a means to this end. It is true that some, in the name of science, have shown an unbridled creativeness comparable with that of our best novelists and have come forth with some remarkable science fictions. The inventor of Dianetics, for example, demonstrated great creativity, but creativity which, from a scientific standpoint, is of no more significance to psychology than Conan Doyle's Lost World is to biology.

The creativity with which we are concerned in this discussion is of quite a different order. In the first place, it is anchored to reality. It begins with relevant facts. A theory without verifiable evidence from unprejudiced observation or experiment has no chance of scientific acceptance today. The scientist's creativeness is here revealed in his discernment of significant relationships among the facts, or in his development of an hypothesis, based upon the known, which may advance the frontiers of knowledge. In the second place, the product of the scientist's creativeness must be susceptible to experimental test. The validity of a theory or hypothesis is determined by subjecting the postulates it generates to critical testing experiments, whose outcome results in the acceptance, rejection, or modification of the theory. Any hypothesis which does not lend itself to such testing is useless, regardless of the creativity of its author.

Creativity is also involved in the development of useful investigative procedures. For example, to solve the problem of how to measure the brightness value of hues, a German physicist invented the flicker photometer. Again, when a psychologist wished to discover whether certain animals have recall memory, his creativity produced the widely used delayed-reaction technique. This sort of creativity is very important in all branches of science. Creativity is also revealed in the ordering or classification of facts. It was such creativity as this which, in Darwin's hands, gave scientific support to the theory of evolution, a theory which goes back to ancient times.

We are concerned, then, with creativity which is grounded in facts, which provides tools for getting more facts, and which orders facts into significant relationships.

Our Workshop program also stresses the deductive method and, more specifically, the hypothetico-deductive method so widely used in the physical sciences.

I must say, at the outset, that psychology is largely still in the inductive stage of scientific development, collecting facts and trying to fit them into a meaningful picture of behavior, especially of human behavior. It has been said previously that this is also true of biology.[1] However, in biology, particularly in the field of genetics, there is something of a hypothetico-deductive nature. Dr. C. C. Little gave an indication of such a procedure when he mentioned how investigators correlate morphological findings. In psychology, we have not as yet gone very far in that direction, although there are attempts to do so which I will mention later. We are in psychology much more at the level of collection, classification, and application of data relevant to human and animal behavior.

At one time there were several so-called "schools" of psychology, each claiming to embrace all that is of significance. There were the Structuralists, with their claim that psychology should confine its attention to conscious experience and leave behavior to the physiologists. The method was introspection, and the outcome was a sort of mental chemistry, with experience analyzed into its elements and attributes in terms of sense and nerve physiology. The relation posited was psychophysical parallelism. Then there were the Functionalists, who laid emphasis on the

* An address given at the Orono Workshop of the Foundation for Integrated Education at the University of Maine, 1953.

[1] "Genetics and Morphology," by Clarence Cook Little, *Main Currents*, Vol. 10, No. 3, p. 51.

functions as against the so-called contents of mind. These also stressed the value of introspection, but they used objective observational methods. They expanded the scope of psychology so that it took in aspects of behavioral adjustment as well as conscious experience.

Out of this school grew Behaviorism, the Watsonian variety which rejected conscious experience as a scientifically observable phenomenon, and with it the method of introspection. The Watsonian behaviorists began a trend which has culminated in the modern preoccupation of psychologists with behavior, studied by methods as objective as those used in the natural and physical sciences. In such a natural science approach, consciousness and psyche have no place, not because they do not exist, but because there is no way that we know of or that we can even imagine by which they can be subjected to scientific investigation. In order to make psychology a positive science, we must focus, as the biologists do, upon what we can observe or make observable. If psychology is to be empirical, we must not go beyond the facts, and introspection, which has been widely used, is of no use because there is no way of proving its validity.

But the Watsonians did not confine their pronouncements to behavior. Their research was operational in the best sense, but their philosophy, which they persisted in mixing with their psychology, was materialistic and antireligious. I remember once hearing a minister say that there were three great problems that faced religion in this time: war, liquor, and behaviorism. Interestingly enough, Watson was also anti-heredity. He did not give any credit (at the beginning, anyway) to heredity. Everything was environmentally determined, a function of the kind of food given, the kind of treatment received as a child, and so on.

Later behaviorists—and one would not be very far off in saying that most present-day psychologists fall into this group — have retained the operational or methodological behaviorism, that is to say, the objective method of the Watsonians, as well as the natural science viewpoint which makes psychology a branch of the broader field of biology. However, they have rejected as philosophically naive the idea that because we are forced to deal with such material things as stimuli, nerve impulses, and muscular reactions, we have grounds for adopting a materialistic philosophy and an attitude antagonistic to religion. The present-day behaviorist, who would be known only as a psychologist, might embrace any philosophical or religious viewpoint, because his behaviorism involves a methodology, an operationalism, and is in no sense a concept of the nature of ultimate reality.

Hunter was one of the leaders in what might be called operational or methodological behaviorism. I remember that at one time he was asked if, as a behaviorist, he did not believe that everything was reducible to the terms of physics, chemistry, and physiology. To this Hunter replied that he felt one could be a perfectly good behaviorist and at the same time a Berkelian idealist, since behavioristic psychology is a method, not a philosophy. He said that for scientific study psychological facts must be regarded as if they were material, but that psychologists have no more notion than anyone else what lies beyond the data studied, and can neither affirm nor deny their materiality.

This point of view started a new trend, and it is my belief that this operational variety of behaviorism has had more influence than any other school upon the whole structure of psychology. Probably 95% of psychologists today would insist that there are no schools of psychology. They are all operational behaviorists who study human behavior in the only way possible, as if it were physiological, neurological, and so on, but who do not extend behaviorism beyond method.

All the other schools have also contributed facts and methods. The Gestalt psychologists embraced both experience and behavior, but disparaged any sort of analysis which failed to give priority to meaningful wholes. Their view was that the whole is more than the sum of its parts, and they convinced many other psychologists that there was much to be said for this claim. The Psychoanalysts also made a considerable contribution, which included an emphasis on motivation, a psychotherapeutic procedure, and a conceptual structure which is still the focus of much controversy. McDougall, with his emphasis upon the role of purpose in behavior and his doctrine of instinct, also added to the total picture of present-day psychology.

Each of these schools changed psychology in certain ways (behaviorism most of all) and, having left an indelible imprint, passed out of focus. Today the schools, insofar as they may be said to exist at all, are peripheral. The emphasis now is on psychology. A sort of eclecticism, with respect to methodology and fact, now characterizes our textbooks, both at the elementary and at higher levels.

At the beginning of my remarks, I mentioned that psychology today is in the position of trying to fit together, into a meaningful whole, many seemingly disparate facts about behavior. If I may be excused a crude analogy, we have many bits which we are trying to fit into a sort of jigsaw puzzle. We don't know where all the pieces fit, and we are not sure that some do fit. There is even a great deal of doubt as to what the end product will be when we do manage to fit them together. In this respect we are about where the physical sciences were during the 18th century, before they had an all-embracing conceptual picture of the physical world.

I do not mean to imply that psychologists are interested in collecting any and all facts about behavior. Interest in a certain area, such as learning or vision, will of course narrow one's observations to that or closely related areas. The facts sought will also have relevance in terms of facts already discovered. Or they will have possible practical application. A psychologist will usually preface his report of an experiment

by reviewing previous research, and he will point out that his experiment answers some question, fills some gap in the known facts, or overcomes some shortcomings of earlier research. Sometimes his report will concern the application of a particular procedure to a specific situation where it has not been applied previously, or it may have to do with the tryout, in clinical practice, of a particular test or form of therapy.

In psychological application, also, the degree of empiricism is high. We have learned quite a lot about motivation. We know, for example, that rats learn most quickly and surely when punished for errors and when rewarded for correct responses. But how can we apply this to the classroom? Should we try to apply it? Human beings are different from rats, and the learning of classroom tasks is very different from maze or problem-box learning. Suppose it should seem wise to assume that there is basically no difference between learning a maze and learning geography, who is going to suggest that we manipulate the hunger of children, or that we punish them as we punish animals?

Some findings, however, are applicable. We have discovered that distributed learning, that is, learning with rest pauses between practice periods, is more efficient than massed practice, or learning without rest pauses. So we decide to try this out in the classroom. We find, however, that the rest pauses, to be most effective, must differ for different children, depending upon their intelligence and their powers of concentration, and that the effectiveness of the procedure varies with the kind of material being learned—whether it is boring or interesting to the children. Actually, it is difficult to predict from one situation to another what the effectiveness of our procedure will be. The same is true of all psychological application, in the schoolroom, in industry, and in clinical practice. In vocational guidance, to give another example, the best that we can do for the individual is to tell him that, providing the opportunities arise and he has sufficient interest and application, his chances of success are greater in some fields than in others.

I mention all of this to stress the degree of empiricism which exists in typical psychological research and technology. A high degree of empiricism is also involved in other fields, such as the social sciences and medicine. This is not meant to imply that our scientific endeavors are wasted. We are often forced to guess, but we can guess more accurately than those not acquainted with our facts and procedures. In some fields of application, as in predicting group performances, we can do so well that our services are in great demand, especially in education, industry, and the armed services. But even here we are far behind the physical sciences.

There are several reasons for this lag. In the first place, human beings are much more complex and variable than aspects of the physical world. In the second place, they are influenced by so many factors (hereditary and environmental) over which we have no control. In the third place, human beings, in their personalities and their activities, are influenced by other human beings in many ways: by what others have said and done, by what others are doing and saying, or by what they think others are doing and saying. The complexity of the human being makes some thinkers regard as hopeless the effort to achieve any high degreee of predictability concerning human conduct. In the fourth place, psychology has only begun to utilize methods at all comparable with those which have done so much to reduce the degree of empiricism in physical science.

Of great importance in this connection is the hypothetico-deductive method which, in psychology, has received widespread application only by Hull and his associates. Before discussing this, I should like to say that psychologists are not in general agreement concerning the application in psychology of concepts and methods which have been found fruitful elsewhere. The attempts of the structuralists to analyze consciousness into its elements, and of the behaviorists to analyze behavior into smaller units such as reflexes, has met with a great deal of opposition, from gestalt psychologists among others. This analytic or molecular approach has been criticized as premature. It was pointed out that the physical sciences had gone through a long, exploratory, general phenomenological stage which gave them insight concerning the significant aspects of the spheres with which they deal. In a sense, these psychologists were saying that psychology had too soon broken away from philosophy, which emphasizes the larger, all-inclusive, as against the smaller piecemeal view of man and the universe.

There are also those who believe that at the present stage theory should be avoided in psychology, or at least taken lightly. In a speech given two years ago before the Division of General Psychology of the A.P.A., and published in a recent issue of the *Psychological Revue,* Dr. Dallenbach of the University of Texas referred with evident approval to the statement of Titchener that one should "carry his theories lightly." This meant, according to Dr. Dallenbach, that one should go about his "own proper work of gathering facts. They and they alone verify or disprove theory." He does admit the value of hypotheses, but only under conditions where one can be sure that the phenomena with which the hypotheses deal actually do exist. For example, accepting the reality of Lamarckian inheritance, some biologists developed hypotheses as to how it operates. But only in Russia is the reality of such transmission accepted. Other cases in point are the hypotheses of neural drainage, and of a racial unconscious. Some psychologists, accepting these as actual phenomena, have proceeded to present theories as to how they operate. Not only should we be careful that we do not waste time developing hypotheses about non-existent phenomena, or about phenomena whose existence is questionable, but we should also be sure that our hypotheses are testable.

Unfortunately we have altogether too many hypotheses of this sort in psychology.

Professor Skinner, who has worked mainly in the field of learning, believes that theories of learning are unnecessary. An avowed positivist, his procedure in developing a system of behavior, based upon learning, is that of devising experiments which generate relevant facts. He then relates the facts in such a way as to enable him to discern laws governing their relations. Unlike the procedure of the hypothetico-deductive theory, he has no explicit hypothesis, suggested by a broader conceptualization of the nature of the phenomenon under examination. In common with certain other psychologists, he not only disparages conceptualized systems, but he also criticizes the widespread tendency of psychologists to attempt to explain their results in neural terms, claiming that there is not sufficient knowledge of the workings of the central nervous system to warrant using it in explanations of behavior. His approach is descriptive rather than conceptual, but its real weakness lies in the fact that it is descriptive of the behavior of the rat only, not of human beings. Commenting on Skinner's positivism, Boring says, "Skinner's position is sound and safe for the time being, yet I cannot imagine psychologists being content not to progress further if they can find stable concepts which eventually gain enough versatility to make them seem real—as electricity and atoms are now." In his recent book, *Science and Human Behavior,* Skinner attempts to go beyond purely animal psychology, even devoting a chapter to how to build a culture. Here, however, we find an application not of the findings of his experiments, but of his positivistic views, for his formula is that we should try all cultures, and the one that survives is the best.

Hull and Tolman have developed systems of psychology which involve the sort of theorizing avoided by Skinner. Both have also focussed upon learning. One important reason for this is the belief, held by most psychologists, that the learning process is the key to everything else we study in psychology, be it emotion, memory, thought, personality, or even perception. Also, the learning process is susceptible to study in an objective way, for by using animals as subjects one can even rule out such complicating factors as cultural influences. Hull and Tolman as well as Skinner have made extensive use of rats. However, if an adequate system is worked out to explain how rats learn, there will still be the task of extending the theory to cover human behavior. It is disappointing that even on such a relatively simple phenomenon as maze learning in rats, modern theories are in violent disagreement. Yet this is the only place in which theories of the conceptual variety, so powerful in physics, have yet been applied in psychology. Incidentally, Professor Beach, who is also a rat man, recently gave a speech before the Psychological Association during which he used an illustration of a huge rat in the guise of the Pied Piper, leading the psychologists into the sea. It is true that because the rat, like Drosophila, is such a convenient experimental tool, psychologists have over-concentrated their attention upon it.

Hull's first postulates concern stimulus-response events, all of which are verifiable. By hierarchical steps he gets to the major and more conceptual postulate of his system, the postulate of habit strength, which is very complicated. This postulate, which seems reasonable in the light of the outcomes of much psychological research in the fields of motivation and learning, suggests several other hypotheses which may be tested experimentally, thus pushing our knowledge beyond the stage already reached.

The important thing to remember is that all such systems as these are tentative. They stand or fall upon the accuracy of the predictions they generate. Carried to its logical conclusion, Hull's approach might finally give us a series of mathematically accurate laws or principles and an objective envisagement of the learning process which would explain learning by stating the environmental, physiological and behavioral conditions necessary for its occurrance. Given certain aspects of these conditions, we could then predict the others. What is hoped for is something as all-embracing as the formulae of, let us say, nuclear physics. Hull admitted that behavior may be too complicated for precise mathematical formulation, but he believed that the effort might have worthwhile results. Actually his system has suggested many problems and stimulated many investigators, although critics sometimes disparage his preoccupation with learning, saying that it fails to consider the motives, purposes, ideals, and values so typical of human behavior.

Tolman's approach, even though it is based upon research with rats, does come closer to this "higher level" of behavior. He emphasizes purposive variables, including such phenomena as "demands" which the organism makes upon its environment, and the "expectation" that such and such behavior will bring such and such results, based upon previous learning. Correct performance, he claims, is guided by a knowledge of the significance of stimuli as guide posts. Whereas Hull makes the animal an automaton under the control of stimuli, Tolman makes him a knowing organism reacting in terms of his knowledge. In his tentative selection of his constructs, Tolman says that he imagines what he would do if placed in the same predicament as the rat. He thus looks for variables which characterize human behavior. Actually, from the standpoint of generating testable postulates, Hull's system is more fruitful than Tolman's, which has never gone far beyond the verbal stage. Tolman has come to the conclusion, concurred in by many others, that there are actually different kinds of learning, and that we do not have a theory capable of explaining all of them.

From what has been said, it is obvious that psychology is far from achieving either *a* method which is capable of solving its problems, or an overall conceptual scheme into which it can fit all of the facts revealed by its various methods, schools, and cur-

rent systems. We do not even have an adequate conceptual theory of learning. Therefore I want to say again that psychologists should not be expected to explain purpose, belief, ideals, or other such human intangibles. These problems are properly the field of philosophy.

Nevertheless, over the seventy-odd years of its history, psychology has accumulated an immense amount of verifiable information, and it has developed many methods of solving particular problems, including many of the practical problems of the individual, the school, business, and industry. Despite the absence of adequate overall theory, while operating with a high degree of empiricism, we have made much progress.

When one stops to consider it, psychology is a field which provides a marked degree of integration for the facts of other sciences. Human behavior is probably much more complicated than any model which the physicist or chemist, or both combined, could produce. It is this complexity which makes it necessary for those who try to understand human behavior to look to physiology, sociology, anthropology, and other relevant fields for explanatory information. We can think of psychology as a focal point for findings from philosophy, physiology, physics, chemistry, sociology, genetics, anthropology, and biology. Psychology, so to speak, synthesizes or integrates these relevant findings, and in turn serves to pass on valuable information to anthropology (stimulating research), sociology (personality, group dynamics), religion (pastoral psychology), education (tests, guidance, etc.), art (aesthetics), psychiatry (theory and psychotherapy, as well as tests), international relations (racial differences), and so on. Therefore it may be said that the useful applications of psychology are, or can be, almost infinite, and that these are just in their beginnings.

SOURCE READINGS: INTEGRATIVE MATERIALS AND METHODS

SOCIAL IMPLICATIONS OF GENETICS

"Social Implications of the Genetics of Man" was the subject of Dr. A. H. Sturtevant's presidential address at the Pacific Division of AAAS, Pullman, Washington, June 22, 1954, reprinted in *Science,* Vol. 120, p. 405-407, 1954.

The author explains that man is the most unsatisfactory of all organisms for genetic study and that obviously no geneticist would study such a refractory object, were it not for the importance that a knowledge of human genetics has in other fields.

"There are enough unambiguous examples known to make it clear that the same principles are at work in man as in all other higher animals and plants—and even without such evidence, enough is known about the cytology of human tissues to give us confidence that no peculiar kind of inheritance is to be expected in man."

There is considerable disagreement as to how much observable diversity is due to environmental effects and how much is due to genetic differences. "At the sensory level there is good evidence for inherited differences. There can be no question that such things as color-blindness, or sensitivity to the bitter taste of phenylthiourea are simply inherited . . . As has been pointed out by Blakeslee, we all live in different worlds by virtue of inherited differences in our energy reactions to external stimuli. It should further be pointed out that these differences have effects at the highest mental levels."

A genetic analysis is most difficult when one is dealing with complex characters. "But it seems safe to conclude, from what we know of the genetics of complex characteristics in other organisms, that any property as complex and variable as [the sensory components of human mentality] must have a large amount of underlying genetic diversity.

The author devotes the remainder of the paper to the effects of high-energy radiation on the genetic properties of man. "There are two possible types of radiation damage to be considered — damage to the exposed individual and damage to the genes in his germ cells. The first will be more or less immediate in its manifestation, whereas the latter will have detectable effects only in future generations."

Dr. Sturtevant says that there are certain general qualitative results of irradiation tests that have now been so widely confirmed that we may confidently apply them to all higher organisms, including man. "These results are (1) High-energy irradiation produces mutations. (2) The frequency of induced mutations is directly proportional to the dosage of irradiation. There is almost certainly no threshold value below which irradiation is ineffective. (3) The effects of successive exposures are cumulative. (4) The effects are permanent in the descendants of the affected genes. There is no recovery. (5) The overwhelming majority of these mutations is deleterious—that is, they seriously affect the efficiency of individuals in later generations in which they come to expression. These deleterious genetic effects may lead to early death or to any of a wide variety of defects, often gross ones."

The author reminds us that there is a store of such undesirable genes already present in any population. What irradiation does is to add to this store. "The probability of an effect on the germ cells of any one individual may be very low; but when many millions of people are being exposed, it becomes certain that some of them will be affected." Dr. Sturtevant expresses his concern over the small increase in natural "background" radiation in some localities within the

continental United States and elsewhere. "Every geneticist familiar with the facts knows that any level whatever is certain to be at least genetically harmful to human beings when it is applied to most or all the inhabitants of the earth.

"I do not wish to be understood as arguing that the benefits ultimately to be derived from atomic explosions are outweighed by the biological damage they do. It may be that the possible gains are worth the calculated risk. But it must be remembered that the risk is one to which the entire human race, present and future, is being subjected." —*Ruth Lofgren*

SCIENCE AND IDEOLOGY

The use and misuse of scientific findings in philosophy and ethics is discussed by Adolph Grünbaum in an article entitled "Science and Ideology" that appears in *The Humanist* (1954, No. 4, pp. 161-173).

"When new conditions pose basic problems whose solution, though urgent, is not achieved, a crisis develops in human affairs. Ideological cleavage develops, for even if the ills point univocally to the remedy, the polymorphism of human thought generates rival diagnoses; and thence issue conflicting proposals for social reconstruction in economics, politics, religion, education, and the arts." The author suggests that only man's powers of rational or scientific thought can solve the multiple puzzles of existence.

"The laws of nature comprise statements asserting what normal behavior is as well as descriptions, both qualitative and quantitative, of the kinds of changes that will ensue from given types of causes. It is by virtue of such laws that the various particular events which we call causes are seen to explain the particular occurrences which we call their respective effects. Our quest for explanation, however, does not cease at that point. For we endeavor to explain not only particular phenomena but also the patterns of their occurrence."

In answer to the question, "Why does the universe possess the structure described by these laws and not some other equally conceivable structure?" the author quotes from Bacon, who urges us to see that the most comprehensive principles of nature simply are what they are as a matter of brute fact, and that all explanations proceed within the framework of these principles. And, as Professor Grünbaum explains, "To seek an underpinning of any kind for these most basic laws is to misconceive explanation in a fundamental way. On the other hand, the recognition of their brute-fact character enables us to understand the basis for the indispensability of the experimental method in our search for knowledge of the world; since even the most comprehensive laws of nature have an infinity of logically conceivable alternatives, we must employ sensory awareness rather than mere thought to ascertain which one of this infinity of conceivable structures is, in fact, embodied in the actual world."

The author points out that the dogmatic blunder concerning the inviolate natural order which gives rise to the miracle concept has also been committed several times within scientific theory with resulting penalties of confusion. "When Galileo enunciated the law stating that it is natural for a body to continue moving with constant velocity when no new external forces are acting on it, his Aristotelian critics asked him to specify what causes kept the body from slowing down and coming to rest. Their question was inspired by their underlying contrary assumption that it is natural for bodies to come to rest when no forces are acting on them. And thus they failed to see that Galileo's more intensive and more careful observations had taught him that the normal behavior of things is indeed different from what they had supposed it to be."

Among those who sincerely endeavor to maximize human welfare in respect to health, material well-being, cultural opportunities, etc., Professor Grünbaum explains, there is sometimes strong disagreement as to what mode of economic organization will bring about the desired end.

"Thus, by applying the acid test of fact to *a priori* conceptions of man that restrict the contexts within which human betterment might otherwise be attempted, the scientific method opens new vistas for the solution of man's problems." —*Ruth Lofgren*

BODIES PHYSIOLOGIC AND POLITIC

Several decades ago the brilliant physiological experimentation of Walter B. Cannon established the delicate balance or homeostasis characterizing the coordinated function of the organs and tissues of the body. Later he attempted to apply this same concept to certain aspects of the social and political behavior of man. A recent issue of the *Scientific Monthly* (1954, LXXIX, pp. 20-26) contains an abridged version of these later formulations first published in 1941. While the presentation in "The Body Physiologic and the Body Politic" is strictly analogical, it deals with the expansion of a unifying concept which competent investigators have shown to have application at widely different levels of integration.

Working predominantly with the organism's nutritive needs, Curt Richter has shown that a homeostatic principle maintains the healthy organism-as-a-whole in delicate balance with the environmental medium. Allee and other ecologists have demonstrated an identical type of relationship in any balanced community of living forms, so that a change affecting any one type of inhabitant will, in turn, bring about an alternation within the entire biological community. On a still larger scale there is the reciprocal balance of function between the entire animal and plant worlds. Alfred Emerson has recently applied the concept to the ethical spheres of man's life, while Sinnott conceives of "purpose" as a special aspect of self-regulating systems, and holds that homeostasis "is not simply a curious process in physiology" but "the satisfaction of our most basic desires." —*William E. Galt*

INTEGRATIVE PROGRAMS IN COLLEGES

A New University College in England

When in October, 1950, the new University College of North Staffordshire opened its doors to students, the event attracted widespread attention in educational circles. There were several reasons for this. It was the first new university institution to be founded in England for a long time. But there was more to it than that. If it had been proposed to start a new college of the existing type, it is unlikely that it would have received effective support. But the promoters of the new college pointed out that while modern universities have carried out a magnificent task, they have their defects. They have tended more and more to produce specialists.

It is true that modern civilization depends on the experts. The skilled professional has become the essential cog in a complex machine. We need our engineers, scientists, and doctors. We also need trained economists and lawyers. All these specialists keep the machine of civilization working. But the question which many thinking men are asking today is: where is the machine going? We need leaders with judgment, and for this, width of outlook is often better than narrowness of interest. A broad, general training may yet be a better preparation for leadership than expert knowledge of a restricted field.

Return to a Broad Curriculum

In favor of a new university college it was argued accordingly that the time was ripe for something different in university education—at any rate in Great Britain—and that what was needed was a return to something like the broad curriculum provided in the early days of Oxford and Cambridge. The college is not intended to be in competition with other universities. The intention is to produce something different and yet equally valuable and this can be done by developing a seat of learning where a general rather than a specialized training is the rule.

We believe that there is one essential condition for success: the college must be fully residential. To obtain the greatest benefit from a general education, students should take part in a full corporate life, for only so can there be a real exchange of ideas between students. The appreciation of different points of view may often be more helpful than the formal discussions of the lecture room. The stimulus of the teacher, the cooperation of fellow-students and the training of self are the ingredients of successful university life. There are now about 500 students living on a beautiful estate in Staffordshire, and we hope gradually to have more.

The college has been empowered to confer the degree of Bachelor of Arts, with or without Honors. To provide as wide an education as possible the course extends over four years. In their first year all students go to the same set of lectures, whatever they want to study later on. In this, the curriculum differs from that of all other English universities. The object of this first-year course is to provide a general setting for the more specialized studies which follow. Its aim is to depict the map of knowledge in broad outline so that the student may appreciate the relation of one subject to another.

The trouble with much that passes for education today is that it is piecemeal. It involves close knowledge of a limited field with only a vague notion of its connection with other regions of knowledge. A broad education should be synonymous with widely-spread, well-balanced, and integrated knowledge. At this point I may mention that students are not allowed to proceed to the more specialized degree courses unless they pass an examination test at the end of their first year.

Throughout their last three years students are required to read two principal subjects to an equal level. Whatever they may be, whether two science subjects like physics and chemistry, or two arts subjects like English and history, it is hoped so to teach them that they are brought in close relation to each other. In addition, the students must read other subjects to a subsidiary level in such a way that at least one of them, whether principal or subsidiary, is taken from the arts group, one from the social sciences, and another from the experimental sciences. The course might be likened to a pyramid, the first year forming the broad base and subsequent years involving a narrowing field with increasing depth.

A great deal of thought has been given to the content of the course for the first year. Its main purpose is to show the inter-relation of the different fields of knowledge so that students of the arts and social sciences may get some idea of the aims, methods, and achievements of the scientist and the effect of his discoveries on civilization today. At the same time the student intending to read science should have some idea of the heritage of thought and learning that has been transmitted to us from the ancient world and subsequent generations.

The course has accordingly been built up round three main themes. One of these general topics concerns man as a living organism and the world in which he lives under the title of "Man and His Environment." This provides an opportunity to discuss in general terms what physics, chemistry, and biology are about without necessarily calling these subjects by name. To put man into his proper setting, it is necessary to discuss the strange immensity of the dimensions of space and time which astronomy forces us to accept about the universe around us. This leads to a discussion of the earth and man's geographical environment. By suitable treatment, the subjects of physics, chemistry, geology, and biology can be merged into a uni-

fied whole and the usual departmental barriers broken down.

Man has developed far beyond other living organisms because he has devised methods of communication from one generation to another, and so can transmit knowledge and ideas to his successors. In this way cultural continuity is maintained. The next main theme shows how the body of present knowledge has accumulated and this is done under the title of "The Transmission of Knowledge." The legacies of the ancient world are surveyed, not only in science but also in literature, art, and philosophical thought. This is followed by a brief history of the Middle Ages in England and the limited literary achievements which have been handed down to us. So the way is prepared for the exciting period of the Renaissance and the Reformation, with the wealth of the literature which it produced. The student is introduced to the age of discovery and adventure, not only in the geographical sense but also in the fields of science and philosophy.

Man is a communicating animal but he is also a gregarious animal and there is a tendency to form groups with a similar cultural background. This leads to the emergence of society, and new problems arise because man has to effect a compromise between his urge for self-preservation and the desire to maintain the society of which he is a member. So the relation of man to society has to be considered. This relation is complicated today by the discoveries of science and their effects on industrial development. So in the third main theme, under the title "Industrial Society," a course of lectures is given on the economic changes brought about in the nineteenth and twentieth centuries, and this leads to an account of the political and social institutions of today. In this way the student is brought face to face with some of our modern problems and is given some idea of the developments which have produced them.

Students' Active Part

The treatment of each of these three main themes extends over a term and the whole course involves about 300 lectures. To stimulate the student to take an active part, he becomes a member of a small discussion group, and these groups meet once a week to discuss general topics arising from the content of the lectures. For example, a student may be required to write and read an essay or be called upon to address the other members of the group. A senior member of staff presides over each discussion group in order to guide its deliberations and encourage the students to read for themselves about the subjects dealt with in the lectures.

The design of the course calls for much consultation between the various professors, and the attempt to produce an integrated syllabus of lectures has provoked much thought as to the proper basis of university education.

A general course like this provides a break in studies at a critical point in a student's career. After concentrating on the requirements of leaving examinations at school he is free to pause for a while to look around and to take stock. He is introduced to new lines of inquiry and to novel points of view. The course prevents the automatic continuance at the university of the subjects studied to a specialist degree at school. It has been found that students often acquire new interests and their career takes a new turn as a result of the new fields of knowledge that have been brought to their attention for the first time. As the advantages of such a general education become more widely known, it is hoped that there will be an ever-increasing demand for graduates of this kind. It may be claimed at the least that they will be better fitted to take their places as citizens in the modern world. (*Broadcast in the BBC's General Overseas Service*)

NEWS AND NOTES

A new Center for Advanced Studies in the Behavioral Sciences was instituted in September 1954 near the Stanford University campus in the San Francisco Bay area. This is the first time that such opportunity has been afforded for a continuing group study in human behavior, and it is now possible due to a $3,500,000 grant from the Ford Foundation, which as long ago as the fall of 1950 defined its interest in studies of human conduct and established its Behavioral Sciences Division.

The history of the Center itself began with preliminary conferences in the fall of 1951, and with a meeting in March 1952 of an ad hoc group of fourteen behavioral scientists and academic administrators, representing seven disciplines and nine universities, brought together to advise and consult with the Ford Foundation on the best ways of meeting the problem of advanced training in the behavioral sciences. That group unanimously recommended the establishment of a center, and indicated its major characteristics. It was felt that an institutional innovation alone would provide a setting in which young behavioral scientists could be brought abreast of the highest level of knowledge, insight, research experience, and scholarship presently available, but now unavoidably scattered among the faculties of many universities.

The president and executive director of the Center is Dr. Ralph W. Tyler, former dean of social sciences at the University of Chicago. Participants in the Center's work will consist primarily of two groups: first,

ten to fifteeen senior scholars serving in rotation on leave from their home institutions for periods normally ranging from six months to two years; and second, a group of thirty to forty promising junior men in residence at the Center for one to two years. In addition, there will probably be a small group of special members in attendance for relatively short periods, such as foreign scholars and governmental personnel. Dr. Tyler has said, with reference to the intent on the part of the Center to draw into its work scholars on leave from their home institutions: "The sabbatical leave is a well-established tradition in the academic world. Its purpose is to provide the mature scholar an opportunity for further self-development freed from the normal duties of college residence. The Center adds the opportunity for a selected number of university faculty members concerned with the study of human behavior to come together in one place, in order to help one another gain new skills and insights, and to work upon common problems in addition to their individual study projects. The behavioral sciences have come to a stage of development calling for a good deal of communication from one specialist to another for the benefit of both. The Center is designed to provide a working atmosphere where this communication can take place." The Center has been fortunate in gathering together an outstanding group of men eminent in the fields of political science, psychiatry, psychology, biology, economics, sociology, anthropology, mathematical statistics, history, and mathematical biology.

The Center is considered as a supplement and an aid to university work. In view of this, plans involve the participation of university staff members, the cooperation of many universities, and opportunities for research and advanced education without in any way attempting to compete with university programs. The Center represents an attempt to advance the behavioral sciences in the same way that other fields of knowledge, like medicine, have occasionally been advanced through the concentration of scholars and resources, resulting in a rapid improvement of the whole level of education and research. It is a pioneering effort, calling for ingenuity, initiative and experimentation, established in two beliefs: first, that the behavioral sciences are important, and second, that they need improvement. It is certainly to be hoped that the Center's five-year program will make a real contribution to our knowledge of human behavior, in support of these beliefs.

The scope of the program of study and research is broad. It has been stated in the report of the Planning Group for the Center that the intellectual scope of the program should not be restricted to the content or the method of the behavioral sciences as narrowly conceived (i.e. social psychology, sociology, anthropology), but it should be receptive to the contribution of other disciplines interested in the central problem of developing a mature science of man. Thus it is felt that the program should include ideas, methods, and personnel from such fields as law, economics and business, history, philosophy, mathematics, biology and humanistic studies.

Among the thirty-six Fellows initially in residence seven are drawn from political science and two from biology. From this latter field the Center has fortunately been able to call upon Ludwig von Bertalanffy and Anatol Rapoport, which ensures that the most urgent of all fundamental considerations will be in the forefront: adequate inquiry into the life process, as it is in itself, so that progress may be made in the study of consciousness of self in man, and study of all in him — theoretical and conceptual invention, language and symbolic invention, self-responsibility and ethical need—that clusters around consciousness.

Everything behaves somehow: atoms, stars, senators, continents, termites. The aim of the Center is specific, to understand that within man which leads in turn to that which is unique in his behavior. To these ends we need far more study of the pre-human aspects of the life process, not only as a useful end in itself, but as a means to the end that what is distinctively human shall be made starkly clear and certain. Through its first appointments in biology it is obvious that the Center will be served with distinction. The names listed under psychology, physiology, anthropology and other branches of knowledge are no less well known and satisfying. All in all here is a great event in the advancement of essential knowledge.

—F. L. K.

The article, "Chaos or Configuration," by H. S. Burr, which appears on page 31 of this issue, is a full summary of the third in a series of addresses offered under the auspices of the Layman's League of the Unitarian Church in Dallas, Texas, by a Colloquium Committee set up for the purpose under the general chairmanship of W. Perry Bentley. This lecture, "Science and the Nature of Man," was given in Boston on May 20, 1954. The first two speakers in the series were J. B. Rhine, Duke University, and F. S. C. Northrop, Yale University.

The objectives of this Colloquium on the Nature of Man have been described as follows:

"The evolutionary history of man may be considered from the viewpoint of his physical development and of his spiritual development which has taken place during the last million years or so. His body has shown little change in the last fifty thousand years; it is relatively stable and may remain so for some time to come. But his spiritual evolution has a Lamarckian characteristic. Since the invention of written language some six thousand years ago, he now inherits the acquired experience of all who have made contributions to the accumulated wisdom of our times.

"As religious liberals we must forever seek the truth about the world, man, and society, for if we pause in this quest we shall become static and dogmatic. Even when we find the current assemblage of truth we know we shall eventually lose it, because new

facts will be discovered to modify it, or some genius will remould it so that certain aspects of the world will have an entirely different meaning.

"It is our duty to acquire valid knowledge to apply to our ways of thinking and living, and we must share it with all who will listen. Only thus can we fulfill our destiny in the great evolutionary scheme of this world and do our part in this eternal process.

"Progress in spiritual life depends upon knowledge. We desperately need to know more about man, society, and the universe, but such knowledge will not come to us if we remain passive. We must work to find it, and that is what this Colloquium seeks to do."

Pantheon Books, New York, acting for the Bollingen Foundation, commenced recently the publication of a series of volumes which are to make more widely available the discussions carried on, chiefly by European scholars, at the invitation of Frau Olga Froebe-Kapteyn, at Casa Gabriella, her villa on Lago Maggiore, near Ascona, Switzerland. The first volume of the series is entitled *Spirit and Nature* (1954, 450 pages, ample index, $5), the contributors being the late Ernesto Buonamuti, Professor of the history of early Christianity at the University of Rome; Friedrich Dessauer, Professor of experimental physics and director of the Institute of Physics, University of Fribourg; C. G. Jung; Werner Kaegi, Professor of history, University of Basel; C. Kerényi, formerly Professor of classical studies and the history of religion, Universities of Szeged and Pecs, Hungary, now Lecturer, C. G. Jung Institute, Zurich; Paul Masson-Oursel, Directeur d'études, École des Hautes-Études, Sorbonne; Fritz Meier, Professor of Oriental philology, University of Basel; Adolf Portmann, Professor of zoology, University of Basel; Max Pulver, writer and internationally known graphologist; Hugo Rahner, Professor of Church history, University of Innsbruck; Erwin Schrödinger, Director of the Dublin Institute of Advanced Studies; Walter Wili, Professor of classical philology, University of Bern.

As we propose to discuss here the significance of this whole enterprise, and to notice the contents of the present volume as representative of an institution, what follows falls naturally under News and Notes.

The reader is asked to bear in mind the basic problem, referred to elsewhere in this issue of MAIN CURRENTS, posed by the human situation to psychologists, anthropologists, and other students of human behavior. So long as these branches of learning concentrate their inquiry upon the physical results of the vital emotional, reasoning, and volitional activities of man, they are reckoned among the positive sciences. In these circumstances the actual orders underlying psychic workings are to be merely inferred, much as are the existence of predictable behavior of electric charges or of magnetic fields.

Such a procedure is obviously legitimate, supposing the theoretical aspect is provided and no facts are neglected. It supplements what we know of ourselves —such as it is—from within, by introspection.

In physics we are past the stage wherein the inferred order is limited to the material domain. The fields, the continuum, and the particles are taken together.

In biology like endeavors are beginning. That genes are both molecular facts and ecological (environmental) potentials seems to be certain, even though in biology knowledge of field forces is as yet not comparable to the study of electricity since the time of James Clerk Maxwell. Just how the gene and the environment are interknit is obscure.

It is singular that psychology, as a science, should lag behind others in this particular. The behavior of people is traced back to the nervous and endocrine systems, and there (for some) the inquiry is to rest until such time as the biophysicists and biochemists, by-passing the subject matter of psychology, explain human behavior in terms of matter and energy. As for mind, let the philosophers take it back as their business. They started all the trouble. Let them settle it.

Fortunately for mankind, the patent fact is that every one of us actually, as a consciousness, dwells inside or on the surface of the psyche. The ills of the mind are also patent facts, and they are known to cause many physical disorders. The reality of the psychic field is so immediate, and our need to understand it is so pressing, that modern man can no longer be patient about the abrogation of the psychologists' duty to provide good working theory about the mind, nor content to be re-committed to mathematical logicians or to diverse physicalists.

Where, then, is he to turn?

The volume before us is instructive. In 1933 Frau Froebe-Kapteyn entertained in late August the first group of guests who came to confront the whole question of the cultural heritage as the projection, along with other behavior, of man as man and not as rat. The very first program was as follows:

Heinrich Zimmer: On the Meaning of the Indian Tantric Yoga; Mrs. Rhys Davids: Religious Exercises in India and the Religious Man; Erwin Rousselle: Spiritual Guidance in Living Taoism; C. G. Jung: A Study in the Process of Individuation; G. R. Heyer: The Meaning of Eastern Wisdom for Western Spiritual Guidance; Friedrich Heiler: Contemplation in Christian Mysticism; Ernesto Buonaiuti: Meditation and Contemplation in the Roman Catholic Church.

Meetings have occurred each year thereafter, the topics being as follows:

1934: Symbolism and Spiritual Guidance in the East and West; 1935: Spiritual Guidance in the East and the West; 1936: The Shaping of the Idea of Redemption in the East and the West; 1937: The Shaping of the Idea of Redemption in the East and the West; 1938: The Configuration and Cult of the "Great Mother"; 1939: The Symbolism of Rebirth in the Religious Imagery of Various Times and Peoples; 1940-41: The Trinity, Christian Symbolism,

and Gnosis; 1942: The Hermetic Principle in Mythology, Gnosis, and Alchemy; 1943: Ancient Sun Cults and Light Symbolism in Gnosticism and Early Christianity; 1944: The Mysteries; 1945: Studies on the Problem of the Archetypal; 1945: The Spirit; 1946: Spirit and Nature; 1947: Man; 1948: Man; 1949: Man and the Mythical World; 1950: From the World of the Archetypes; 1950: Man and Rite; 1951: Man and Time; 1952: Man and Energy; 1953: Man and Earth.

The scholars have been drawn from physics, classics, theology, oriental studies, and every other chief region of human cultural endeavor, East and West. The conference is called Eranos, a shared feast. Each year Dr. Daniel Brody, owner and director of Rhein-Verlag, Zurich, published the texts in a volume, *Eranos-Jahrbuch*. From these Pantheon Books has now begun the publication of selections.

Many people in the United States have long lived culturally on a deficient diet. We too often act as if basic problems began with the Civil War, at most remote, the Revolutionary War. What does the educated person, other than the specialist, know about Philo Judaeus, or mysticism in Islam, or *ecclesia spiritualis,* or biology and the phenomenon of the spiritual? (For the latter see pages 342-370.) He may hear about immortality in church (if he listens) but in his school experience and the adjacent Sunday school these poetic words are seldom if ever connected with the stunning fact that every cell in the listener's own body is part of a chain of glutinous molecules that has never been broken off for the one or two thousand million years during which the process has been going on of providing him with the body he sits in (so to speak).

The flood of books poured out by our presses and reviewed in *The Saturday Review* and the book section of the *New York Times* carries very little about the long history of the free spirit and the contemplative soul of man, working through the deathless clay we call protoplasm.

The appearance, therefore, of these deep musings, fabulously rich scholarship, are drafts on the true treasury of man, his age-old study of himself. For those to whom the originals were inaccessible because of the language barrier, these volumes are quite literally beyond price. For the newer institutions for advanced scholarship, now appearing in the United States, they may prove important messengers from a sister society, meeting high up above the fevered world on the northern shores of lovely Lago Maggiore, reminding us that the measurement of afferent nerve impulses, mapping of tracts on the cerebral cortex, careful recording of the habit patterns of pigeons (and even of communters on the 8:18 express) are bits of a facade. The mansions of the mind are, to be sure, made of quickened clay. Intensive study of all this complex is valuable. But the dweller within can think in light years while his eye observes the dark nebula in Orion, and in truth he appears to be an inhabitant of the universe, a Promethean.

—F. L. Kunz

REVIEWS

MOTIVATION AND PERSONALITY

Seldom has this reviewer been more tempted to quote at length from a book under review than by *Motivation and Personality* by A. H Maslow (Harper and Brothers, New York, 1954, 363 pp., bibliography, appendix, index, $4.50). This work, begun by Dr. Maslow nineteen years ago, has appeared in print as articles in considerable part. Now that this material has been brought together, revised and amplified, we have a significant contribution to psychology which presents "a general theory of human motivation based upon a synthesis primarily of holistic and dynamic principles."

Not only is the author clear and simple in his expression but in many instances he is stirring. This may seem to be strong commendation for a textbook in psychology, but these qualities, in addition to accuracy, incisiveness, and breadth of view and scholarship, make for a rare combination.

We have long needed the scholarly review and analysis of the work of others which has accumulated (and often gained great force) during this century. This is critical integration within the field of psychology itself. We have also long needed someone to bring our sights to focus again upon the warmth and vibrancy of living humans. Both of these things the author has done well. As an example of this sane approach, let us quote: "Obviously a good way to obscure the higher motivations, and to get a lopsided view of human capacities and human nature, is to make the organism extremely and chronically hungry or thirsty. Anyone who attempts to make an emergency picture into a typical one, and who will measure all of man's goals and desires by his behavior during extreme physiological deprivation is certainly being blind to many things. It is quite true that man lives by bread alone — when there is no bread. But what happens to man's desires when there *is* plenty of bread and when his belly is chronically filled?" One can see from this approach to psychology, that the reader is being led to think of motivation among humans from a point of view which is certainly not too commonly found in texts.

Psychologists have traditionally worked upon a variety of categories of "basic" needs. Here the author recognizes ". . . that higher *basic* needs may become, after long gratification, independent both of their more powerful prerequisites and of their own proper satisfactions . . ." This admittedly increases the complexity of human

behavior and requires of the psychologist and social scientist a sensitiveness to the nuances of individual life patterns. The book continues with an excellent development of need gratification, the instinctoid nature of basic needs, an exploration of the hierarchies of these needs, and emerges with the author's theory of self-actualization. In passing, we must comment that the author makes frequent references and criticisms of existing schools of psychology and psychological theories which are invaluable not only in the present case but as review and survey of the history of psychology.

The last half of the book, especially Chapters 12 and 13, is, in the opinion of this reviewer, outstanding in modern psychology in that it is peculiarly aware of the humaneness of humans. Certainly we can go much further in our understanding of ourselves once we cease to equate love with sex, as has often been done, and begin to look upon love as an essential interaction between humans, having in it the essence of agape and the dimensions of altruism.

It is certainly to be said of this book that it is indispensable at this phase of development in biology and psychology because it constitutes a sane, healthy and fresh view of man. It would seem that this contribution should assist in preparing the science of psychology and the social sciences for the new concept regarding "mind" and "personality" which seem to be imminent.

—Harvey W. Culp

THE LEAVEN OF LOVE

The Leaven of Love is a beautifully written and most challenging presentation of Mrs. Izette de Forest's development of the psychoanalytic theory and technique of Sandor Ferenczi (Harpers, New York, 1954, pp. 206, glossary, index, $3.50).

Mrs. de Forest studied for several years with Dr. Ferenczi, and for twenty-five years she has been a practicing analyst, applying and developing Ferenczi's theories and techniques. The book should prove to be a valuable contribution to all those who seek a deeper understanding of people.

Mrs. de Forest summarizes the therapeutic theory of Ferenczi as follows: "The indispensable healing power in the therapeutic gift is love. When this love is offered with openness and honesty, in the service of expert skill, it works as leaven: a leaven which lightens and effectively dissipates the burden of neurotic suffering and brings renewal of integrity and health.

"The needs of the psychoneurotic sufferer were in his mind reduced to an equation far simpler than in the Freudian method of that time. But their satisfaction was far more difficult to effect. That the patient needed love, and only love, was his belief. But how to give this needed love, and in what form, was the complex question."

The author explains the theories upon which the treatment is based, and gives clear and sympathetic illustrations of each of the six stages of the psychoanalytic treatment. She also discusses the objections that have been raised to Ferenczi's technique.

Mrs. de Forest's understanding of the process is clearly demonstrated in her description of the resolution. "The final stage in psychotherapy is a period of research in seeking to become reconciled. The many unsuccessful relationships of the patient's former life are passed in review, are examined and re-evaluated. An attempt is made with fresh eyes and maturing emotions to put the blame where it belongs. Soon it becomes manifest that this is fruitless; that this is indeed out of line with the longing to develop in loving-kindness. Forgiveness of the mistakes in the tragic past becomes a needed expression of love. And, with forgiveness, the past is recognized in a new light. In the newly recovered endeavor to live lovingly with one's parents, with all the significant figures of one's childhood—if only in memory—and with one's self, the patient becomes aware that in all human beings there is true goodness: what the Quakers call 'that of God in every man.' The same train of emotional events takes place in regard to contemporary relationships and, last of all, in regard to the therapist. Here mistakes and misunderstandings, by both therapist and patient, over the long period of therapy, are mutually admitted, regretted, and forgiven. True reconciliation is thereby achieved."

Mrs. de Forest emphasizes the responsibilities that this technique places upon the therapist. He must be a growing personality. "He must have discovered for himself a way of life in which he can work toward self-ripening changes and for increasing self-fulfillment. This in itself gives a sense of happy self-possession and self-confidence, from which there flows an ability to identify with others, to sense and to try to satisfy their individual and mutual needs. This is a creative expression of the second commandment: 'Thou shalt love thy neighbor as thyself.' " The author explains that the psychotherapist speaks through his entire way of life to the patient, teaching him both consciously and unconsciously from the fullness of his own development.

"If man has strayed from the path of healthy growth into the blind alley of neurosis, thus sinning against himself and others, he must minutely examine each point at which he allowed himself to turn aside. Each separation from the path and hence from his true self must be redeemed.

"This redemption is activated by man's need to recover his own nature, by his love for himself. It must be accomplished in the recovered ability to love the parental figure of love. In the success of this remedial accomplishment he has obeyed the second great commandment; for he has learned, through the therapeutic study of his self-betrayal, to recapture his wholeness and thus to give to himself the hope and the healing of love. This recovery ensures gratification of his basic need as a child of God: the need to be, even with those who have harmed him, a creator of loving mutuality, a giver of love."

—Ruth Lofgren

FROM AN ANTIQUE LAND

"It is one of the duties and privileges of man to testify to his experience, to bear witness to the wonder and variety of the world in which he finds himself." With this as his aim, Julian Huxley gives an unusual picture of the Middle East as he saw it during his tours of this area in connection with his duties as first President of Unesco. The book, *From An Antique Land* (Crown Publishers, Inc., N. Y., 303 pp., index, $6.00) derives its title from the first lines of the poem which has the oft-quoted epitaph:

"My name is Ozymandias, king of kings:
Look on my works, ye mighty, and despair!"

In eighteen chapters illustrated by sixty-six excellent photographs by the author, twenty-seven of which are in beautiful color, Dr. Huxley leads us indeed to look upon the works of man as they survive after centuries in the heartland of civilization. As he leads us in this tour, one does indeed despair, but the desperation arises not so much from jealousy or from contemporary man's inability to match these monuments, but rather from the loss we have suffered over the years, both because of natural decay and our own human destructiveness. On the other hand, the reader cannot help but feel pride and hope as well, because of his awareness that these monuments are more importantly testimonials to human creativity and genius than they are monuments to assorted self-appointed "kings of kings."

Dr. Huxley has unique skill in recapturing a great deal of the feeling for the past, and at the same time he presents to us a vivid picture of the present scene. Woven into his travelogue are numerous scholarly references and important lore which he has taken pains to cull for us. Here, too, are vignettes of his personal experiences and of the present-day personalities who are engaged in the creation of the one world of the immediate future against the backdrop of our long past, which is illuminated with grandeur and shadowed undoubtedly with despair.

As an addition to the books which we have reviewed from time to time as being source materials for teachers who would impart to their students an awareness of our cultural heritage, we recommend this one very highly.

—Harvey W. Culp

SCIENCE AND MAN'S BEHAVIOR

Science and Man's Behavior, the very stimulating edited works of Dr. Trigant Burrow presenting his contributions to the fields of biology and psychology, is published by the Philosophical Library, New York, 1953. (Appendix, glossary, index, pp. 564, $6) Dr. William E. Galt, editor of the book, has included the complete text of *The Neurosis of Man,* which is Dr. Burrow's most outstanding publication.

About twenty-five years ago, Dr. Burrow with several co-workers and students sought to establish a laboratory in which the reactions that are felt, in contrast to reactions that are looked at, would constitute the material of investigation. He entered upon an experiment in group-living and in group-analysis that had as its purpose the discrimination between habitual behavior-reactions and those reactions that motivate the organism as a unitary whole. Dr. Burrow brought to the research an excellent background in medicine, biology, and experimental psychology. He studied with Carl G. Jung in Zurich and later played an important role in introducing psychoanalysis in this country. Dr. Galt explains that it was while working at The Johns Hopkins Hospital and in private practice that Dr. Burrow developed the distinctive characteristics of his studies—studies which were later sponsored by The Lifwynn Foundation.

Because we feel that Dr. Burrow's concepts are integral to the field of biology, we will quote extensively from his works to give the reader an opportunity to share these important ideas. "Man is not an individual. He is a social organism. An analysis, whether individual or collective, that is based upon differentiations assumed to rest upon legitimate scientific ground rests in fact upon very transient social artifices and lacks the support of a true biological basis. Man's analysis as an element means his isolation as an element. And his isolation is an essential affront to an organic group principle of consciousness. It is because of this organismic principle of behavior underlying our researches that in the course of time I discarded the term 'group-analysis' in favor of the term 'phyloanalysis.' " [Phyloanalysis: investigating disorders brought about by imbalance of the organism's internal reaction as a whole.]

"With this complete shift in material and objective there went hand in hand the discovery of two patterns of tension that were internally discriminable from one another. These tensional patterns are effective in relating the organism to the environment through the process of attention." One of the tensions is the type of attention that marks the organism's total reaction in relation to the environment—homeostasis; the other tension indicates the intrusion of affect-elements or bias into ordinary attention—wishful fantasies. "It was upon the differentiation of these two neuromuscular patterns of behavior and their relation to the function of attention that our efforts were henceforth centered . . . Reactions internal to the organism of man were now to be investigated through methods and processes which were also internal to man.

"Indeed it is amazing that cultural man should have gone on these many thousands of years naively rejoicing in a form of social adaptation which, though it calls itself 'normal,' rests upon no organismic principle of biological balance but, on the contrary, is beholden to the shifting whimsies of mere superficial mores and moralities.

"When one cuts a finger and severs its tissues, one disinfects the wound and protects it. If necessary, the physician assists the healing process and even guides it. This, however, is as far as the skill, knowledge and wisdom of man can go. The physician cannot do the healing itself. It is the total organism that is the sole power and final authority in the task of reuniting severed tissues. Immediately upon sustaining a wound anywhere within its domain, the total organism sets to work quietly, methodically, surely. Though the orderly function of the organism may be threatened, there is no confusion, no division of motive, no partitiveness. Everything moves harmoniously toward the single objective of closing the breach, and in due time the wound is healed and order is restored.

"There is this same authority within the framework of man's behavior as a phylic organism—an organismic power and final authority in the task of reuniting the severed tissues of human relations. This phylic organism with its central constant is not only a powerful authority; it is a past master in an art that is coeval with the origin of life itself—the art of living wholly and in unison both internally and externally. But, singularly, man does not evoke this power. Nor does he assist it. For he does not know that it exists—he does not know in any objective, diagnostic sense. And not knowing, he feels no urge to know. Yet man has never ceased to ruminate, to indulge in images and fantasies of this central organismic constant. Ever since man lost contact with the

organismic force of this central principle he has vaguely sensed its existence within him. As yet, though, he has been unable to do more than invoke a mental, ditentive concept of it—a concept that invariably breaks down when faced with the test of actual human relationships. And so man has spent endless centuries arguing, moralizing and philosophizing, even though the end product is only dispute, confusion and conflict. This state of conflict in the life of man with its 'moral' issues is not fundamental, as he mistakenly supposes. In its beginning this conflict of motive within the species man was a quite simple accident, an inadvertence in his neurodynamic evolution; and all moral, all affectively 'right' and 'wrong' issues are but the symptomatic reflection of this accident, not its cause. It is like the pain accompanying a gastric ulcer. It is not the pain but the ulcer that is the disease. This inadvertence was associated with the development of the forebrain, the part-brain or with the symbolic segment and its concomitant use of gestures, signs, symbols and words that eased communication, expanded the function of the brain and senses of man and widened environmental frontiers.

"The evolutionary trend of the total organism in creating a specialized organ of attention and interest was biologically most felicitous. It assisted in refining the process of total attention, and thus increased the adaptive capacity of man, individual and phylic. Nevertheless, in spite of this favorable outset, things began to go amiss. They need not have gone amiss. Merely because man found this developmental trend apt and handy, he need not have lost touch with the whole brain and the total organism that lies back of it. But he did. And as a result the part-brain more and more assumed supremacy. The process, however, was extremely slow. Obviously, its beginning took place before the advent of historical records, and then for ages and ages went on so gradually that man did not know what had happened, until finally the function of the part-brain all but completely displaced the function of the whole brain and its matrix, the total organism.

"Naturally, this *faux pas* entailed a serious sidetracking of the primary, unified processes that are vital to total, balanced development. At the same time the phenomenon of awareness or consciousness took a new and unexpected turn. It now differed markedly from the balanced, phylic consciousness that had been evolving slowly, but steadily, surely and constructively. This new awareness, while acutely sensitive as a socio-symbolic mechanism, became increasingly erratic and uncontrollable. It simplified inter-communication, but it cut corners. And somewhere in the long line of its development this new awareness disclosed to man the *image* of self. Inevitably he grabbed this image of self, hugged it and never let go of it. Man had become image- or persona-conscious. This was man's undoing. Instead of continuing in the direction of an increasingly sensitive, phylically whole consciousness, he became part- or self-conscious. The part-brain had assumed the dominant role and a cleavage began to appear not only within single organisms but, as was inevitable, between one organism and another, between 'me' and 'you,' between man and man, and so throughout the phylum. Wholeness—phylobiological, constructive wholeness—was set aside for an image of wholeness.

"Through the sciences of physics, chemistry, mathematics, geology, physiology, ecology and the rest, the brain and senses of man became related by means of its symbolic function to the consistent order of the external universe. But phylobiology requires a further step. It requires not only that man's brain and senses but also that the harmonious function of man's own processes—the consistent behavior of man's own organism—be related to and coordinated with the consistent harmony prevailing in the outer world of phenomena.

"Phylobiologically there is only one quality that counts. That quality is oneness. In the absence of this quality of oneness, all other qualities are meaningless, insubstantial." —*Ruth Lofgren*

ATLAS OF MEN

William H. Sheldon, famous for his previous work on constitutional psychology, has now provided us with *Atlas of Men* (Harper & Brothers, N. Y., 336 pp., 4 appendices, index, $10.00) which presents three photographs (front, side, and back views) of each of 1175 men whose degree and kind of physical variations illustrate the range of Sheldon's "somatypes." There are 88 somatypes represented in all. Age-height-weight tables and curves are provided for each.

The twenty-three year work, during which Sheldon and his associates have studied 6,000 men, stands as a landmark in human morphology. We are happy to bring this volume to our readers' attention and mention a forthcoming review of Whyte's *Accent on Form*, because we feel that these two men are essentially calling our attention to some factor which is powerfully significant if we could only conceive what it might be. Whereas Whyte touches somewhat indirectly upon human morphology, Sheldon has thoroughly explored this area.

In his preface, Sheldon begins by saying: "In earlier volumes of the *Human Constitution* series the question has been raised whether an answer to some of the bafflements of life may possibly be contained within the program and philosophy of a biological humanics. By this is meant a science of man resting on biological descriptions and procedures. One major step toward such a science might be contained in a basic structural taxonomy of human beings.

"The history of science could be written as a heroic saga depicting a somewhat halting growth of human faith in the proposition that structure and behavior are continuously related in this world; and indicating a gradual extension of control over behavior through paying heed to structure. Modern organic chemistry would be an instance in point."

The author cautiously suggests relationships between his work and genetics, and here his brief review of the problems and concepts both of genetics and human morphology is clear and valuable.

The vast accumulation of technical and case material in this volume is obviously too great to review here with any justice. This atlas should be studied with care and with an eye to creatively fresh concepts by specialists in many fields. Only thus can this splendidly organized demonstration of the potentialities of an "accent on form" fertilize the growth of much-needed, long-delayed concepts which might release the human and social sciences from some of their present troublesome blind alleys. —*Harvey W. Culp*